(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
14 October 2004 (14.10.2004)

PCT

(10) International Publication Number
WO 2004/088155 A1

(51) International Patent Classification[7]: F16C 11/06

(21) International Application Number:
PCT/GB2004/001295

(22) International Filing Date: 25 March 2004 (25.03.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0307425.9 31 March 2003 (31.03.2003) GB

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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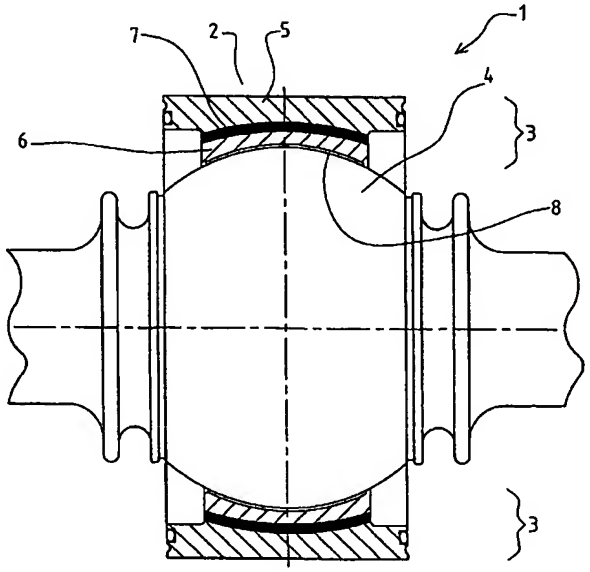
(54) Title: A SPHERICAL BEARING ARRANGEMENT




(57) Abstract: A spherical bearing arrangement (1) having a bearing housing (3) and a ball (4) located therein, the bearing housing (3) having an outer housing (5), an inner housing (6) and an annular elastomeric portion (7) sandwiched between the housings (5,6) and a method of making the same comprising the steps of: swaging an inner housing (6) onto a ball (4); providing an annular elastomeric portion (7) around an outer surface of the inner housing (6); and swaging an outer housing onto the elastomeric portion (7).

WO 2004/088155 A1

**Published:**
— *with international search report*
— *with amended claims*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# A SPHERICAL BEARING ARRANGEMENT

This invention relates to a spherical bearing arrangement and more particularly to a spherical bearing incorporating an elastomeric portion.

GB-A-2 263 948 discloses a so-called hybrid bearing 100 comprising an outer and middle housing 101,102 between which is sandwiched an annular rubber layer 103. The inner surface 104 of the middle housing 102 is formed with steps 105 to receive a multi-part inner housing 106 which is constructed within the middle housing 102. In the particular example shown in Figure 1 of the accompanying drawings of a hybrid bearing, the multi-part inner housing 106 is assembled and pushed into the middle housing 102 which has the rubber layer 103 bonded to its outer surface. The outer housing 101 is then swaged and bonded onto the rubber layer 103.

This construction is disadvantageous because it adds approximately 15% in diameter to a comparable non-hybrid bearing because of the additional parts necessary to contain the elastomeric part of the hybrid bearing. It is an object of the present invention to reduce the size of hybrid bearings and also to provide a method of manufacture which is simpler than conventional methods such as that disclosed in GB 2 263 948.

Accordingly, one aspect of the present invention provides a spherical bearing arrangement having a bearing housing and a ball located therein, the bearing housing having an outer housing, an inner housing and an annular elastomeric portion sandwiched between the housings.

Another aspect of the present invention provides a method of manufacturing a spherical bearing comprising the steps of: swaging an inner housing onto a ball; providing an annular elastomeric portion around an outer surface of the inner housing; and swaging an outer housing onto the elastomeric portion.

In order that the present invention may be more readily understood, embodiments thereof will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic cross-section of a spherical bearing arrangement not in accordance with the present invention; and

Figure 2 is a spherical bearing arrangement embodying the present invention.

Referring now to Figure 2 of the drawings, a bearing arrangement 1 embodying the present invention is shown and comprises a spherical bearing 2 having a bearing housing 3 and a ball 4 located therein, the bearing housing 3 having a rigid steel outer housing 5 and a rigid steel inner housing 6 between which is sandwiched an annular elastomeric portion 7, in this example, a rubber sleeve bonded to both housings 5,6. The outer housing 5 of the bearing housing may be securely held in an interference fit hole (being an interference fit hole because the internal diameter of the hole is less than the outer diameter of the outer housing 5).

Preferably, a self-lubricating liner 8 is provided on the inner surface of the inner housing 6 in contact with the ball 4. Alternatively, the inner housing 6 and ball 4 may be in direct contact with one another.

The bearing is manufactured as follows. Firstly, the inner housing 6 is swaged onto the ball 4. The elastomeric portion 7, the rubber layer, is then bonded to the inner housing, preferably by an injection process. 4. Finally, the outer housing 5 is swaged onto the inner housing 6, sandwiching the rubber layer 7 between the housings 5,6. Preferably, in addition to being swaged onto the rubber layer 7 around the inner housing 6, a layer of adhesive is applied between the outer housing 5 and rubber layer 7 by which the rubber layer 7 is bonded to the outer housing 5.

The liner 8 is not essential - the inner housing 6 and the ball 4 are both happily manufactured from a metal or metal alloy with the inner housing in direct contact with the ball.

The resultant hybrid bearing housing 3 has three main components, none of which need be multi-part components and, because of the small number of components, there is a significant space saving because the size of the outer diameter of the housing has been reduced. Comparing the example of the invention shown in Figure 2 with the conventional hybrid bearing shown in Figure 1, it will be appreciated that the invention allows the entire middle housing 102 shown in Figure 1 to be dispensed with by adopting a simpler manufacturing process which leads to a reduction in the diameter of the bearing housing.

The spherical bearing has inner and outer housings 5, 6 between which are sandwiched the annular elastomeric portion. The housings and the elastomeric portion surround, capture and house the ball. Referring to Figure 2 of the drawings, it will be noted that the ball has a diameter and the housings and the annular elastomeric portion surround that diameter at the equator of the ball.

Both the inner housing and the elastomeric portion are curved around the ball - again see Figure 2. It should be noted that, due to the curvature of the elastomeric portion and the inner housing around the ball, the spherical bearing embodying the present invention is able to absorb relative movement between the ball and the outer housing both in the radial direction and in the axial direction. Thus, in embodiments of the invention, because of the curvature of the elastomeric portion, there is also an element of compression of the elastomeric element between the inner and outer housings during any axial loading on the spherical bearing.

In the present specification "comprises" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

**CLAIMS:**

1. A spherical bearing arrangement having a bearing housing and a ball located therein, the bearing housing having an outer housing, an inner housing and an annular elastomeric portion sandwiched between the outer and inner housings, wherein the housings and the annular elastomeric portion surround the equator of the ball and the inner housing and the annular elastomeric portion are curved around the ball.

2. A bearing arrangement according to Claim 1, wherein the elastomeric portion is bonded to the inner housing.

3. A bearing arrangement according to Claim 2, wherein the elastomeric portion is bonded to the inner housing by an injection process.

4. A bearing arrangement according to any preceding claim, wherein the elastomeric portion is bonded to the outer housing.

5. A bearing arrangement according to any preceding claim, wherein a liner is provided on the inner housing in contact with the ball.

6. A bearing arrangement according to Claim 5, wherein the liner is a self-lubricating liner.

7. A bearing arrangement according to any one of Claims 1 to 4, wherein the inner housing and ball are both manufactured from metal and the inner housing is in direct contact with the ball.

8. A bearing arrangement according to any preceding claim, wherein the elastomeric portion is rubber.

9. A method of manufacturing a spherical bearing comprising the steps of:
swaging an inner housing onto a ball;
providing an annular elastomeric portion around an outer surface of the inner housing; and
swaging an outer housing onto the elastomeric portion.

10. A method according to Claim 9, wherein the step of providing the annular elastomeric portion around the outer surface of the inner housing comprises bonding an elastomeric portion to the outer surface of the inner housing.

11. A method according to Claim 10, wherein the elastomeric portion is applied by an injection process.

12. A method according to any one of Claims 9 to 11, wherein the outer housing is swaged onto the elastomeric portion.

13. A spherical bearing arrangement substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

14. A method of manufacturing a spherical bearing substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

## AMENDED CLAIMS

[received by the International Bureau on 01 September 2004 (01.09.04);
original claims 1-14 replaced by amended claims 1-12 (2 pages)]

1. A method of manufacturing a spherical bearing comprising the steps of:
swaging an inner housing onto a ball;
providing an annular elastomeric portion around an outer surface of the inner housing; and
swaging an outer housing onto the elastomeric portion.

2. A method according to Claim 1, wherein the step of providing the annular elastomeric portion around the outer surface of the inner housing comprises bonding an elastomeric portion to the outer surface of the inner housing.

3. A method according to Claim 2, wherein the elastomeric portion is applied by an injection process.

4. A method according to any preceding claim, wherein the outer housing is swaged onto the elastomeric portion.

5. A spherical bearing arrangement having a bearing housing and a ball located therein, the bearing housing having an outer housing, an inner housing and an annular elastomeric portion sandwiched between the outer and inner housings, wherein: the outer housing has an outer surface to allow the outer housing to be securely held in an interference fit hole; the housings and the annular elastomeric portion surround the equator of the ball; and the inner housing and the annular elastomeric portion are curved around the ball.

6. A bearing arrangement according to Claim 5, wherein the elastomeric portion is bonded to the inner housing.

7. A bearing arrangement according to Claim 6, wherein the elastomeric portion is bonded to the inner housing by an injection process.

8. A bearing arrangement according to any one of Claims 5 to 7, wherein the elastomeric portion is bonded to the outer housing.

9. A bearing arrangement according to any one of Claims 5 to 8, wherein a liner is provided on the inner housing in contact with the ball.

10. A bearing arrangement according to Claim 9, wherein the liner is a self-lubricating liner.

11. A bearing arrangement according to any one of Claims 5 to 8, wherein the inner housing and ball are both manufactured from metal and the inner housing is in direct contact with the ball.

12. A bearing arrangement according to any one of Claims 5 to 11, wherein the elastomeric portion is rubber.

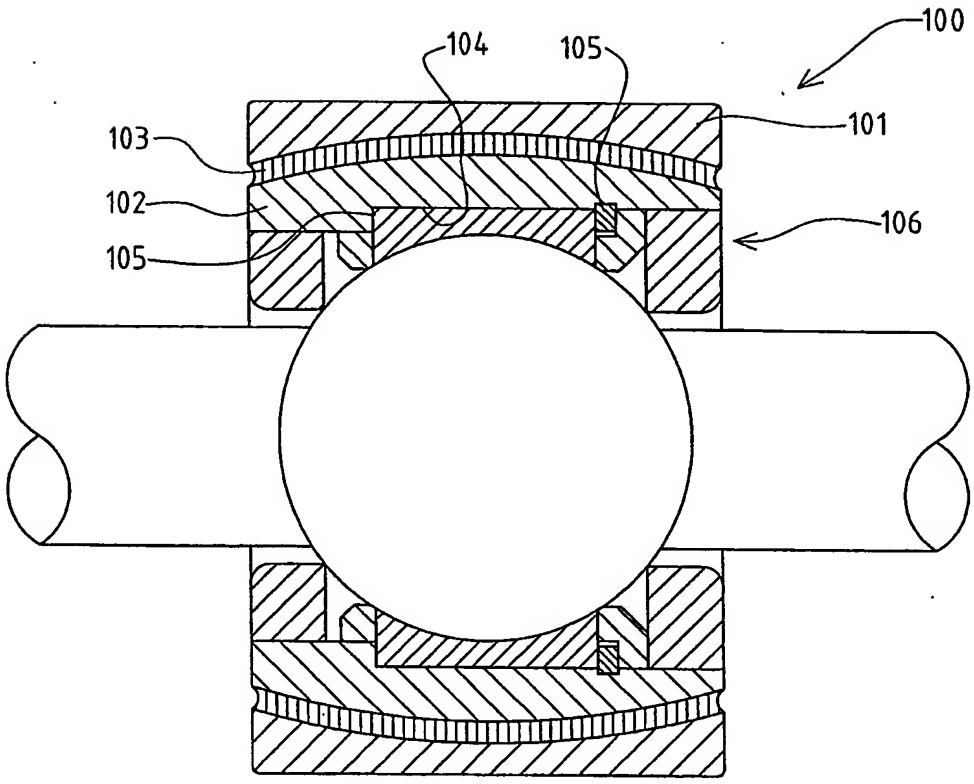



FIG 1

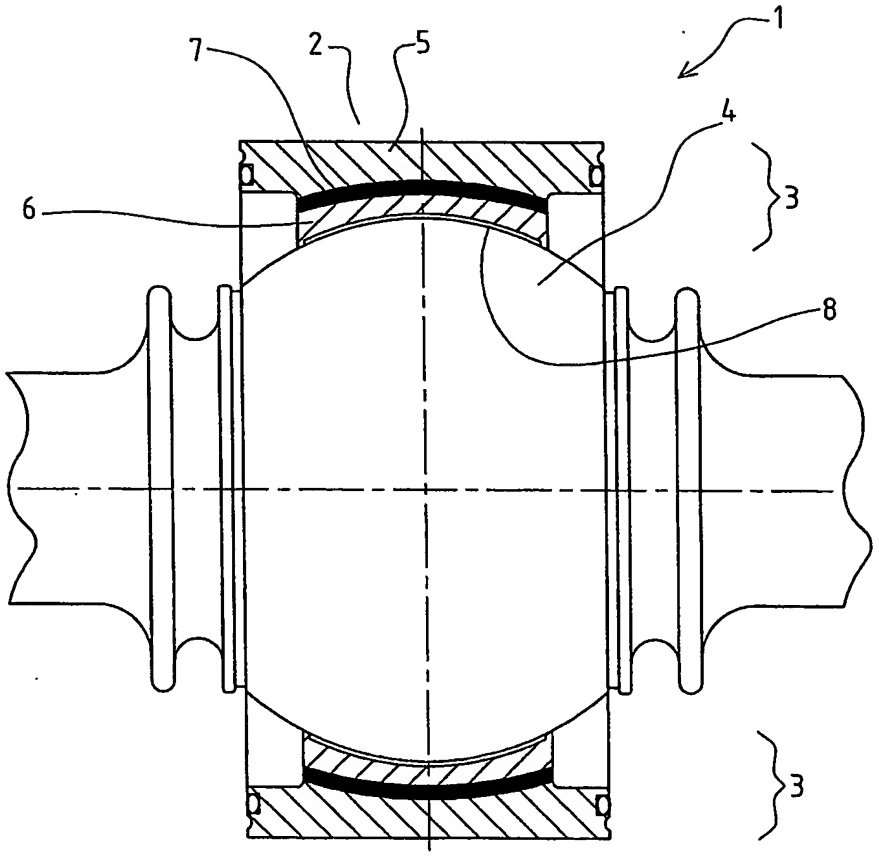



FIG 2

# INTERNATIONAL SEARCH REPORT

Intq ial Application No
PCT/GB2004/001295

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16C11/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F16L F16C B60G B62D F16F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
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| X | US 5 902 050 A (SOLOMON RANDALL L ET AL)<br>11 May 1999 (1999-05-11)<br>column 2, line 11 -column 3, line 12;<br>figure 2B | 1,2,7,8,<br>13,14 |
| X | US 3 243 239 A (HACKMAN KENNETH V)<br>29 March 1966 (1966-03-29)<br>column 1, line 69 -column 2, line 67;<br>figures 3,5 | 1,2,5-7,<br>13,14 |

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 17 June 2004 | 02/07/2004 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31–70) 340–2040, Tx. 31 651 epo nl,<br>Fax: (+31–70) 340–3016 | Axelsson, T |

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Inter al Application No
PCT/GB2004/001295

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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